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Fakultas Sains dan Teknologi

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Volume 1, October 2014

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PREFACE

The 1st International Conference on Science and Technology for Sustainability 2104 (ICoSTechs2014) is an international event hosted by Faculty of Sciences and Technology, University of Islam Negeri Sultan Syarif Kasim Riau (UIN SUSKA Riau). The purpose of this conference is to provide a forum for researchers, scientists and engineers to exchange new ideas and interact in-depth through discussion with peers from all over the world in the fields of electrical and electronics engineering, informatics, mathematics and industrial engineering. The main goal of this event is to facilitate communications among researchers and practitioners, not only concerning the core areas but also involving multi –disciplinary and interdisciplinary work.

We are grateful to all those who have contributed to the success of ICoSTechs2014. There are a number of parties that have assisted us in organizing this conference become a reality. We would like to thank all authors, participants, faculty members for their participation and support, IEEE Indonesia sections, IIIT (The International Institute of Islamic Though) and BKS PTN Barat (State Universities Cooperation Agency of Western Region). Last but not least, we greatly appreciate the committees and external reviewer's precious and timely reviews. Their expertise is very vital in ensuring the success of this event.

We really hope that all participants benefit tremendously from the conference. Finally, we would like to wish the participants success in the presentations and social networking.

Dr. Alex Wenda
General Chair
The 1st International Conference on Science and
Technology for Sustainability 2104, (ICoSTechs2014)
Batam, Indonesia.

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WELCOME

First, blessing and mercies so we can be here together in this room to healthy condition. And we also convey our syallawat to Prophet Muhammad.

Nowadays, sustainability has been an emerging major issue of the world in order to create a Better Life for the Current and Future Generations. Achieving a Sustainable Development will require changes in many fields, including Sciences and Technologies.

More than one hundred definitions of sustainable development exist, but the most widely used one is the definition from the Brundtland Report of the World Commission on Environment and Development, presented in 1987. It states that sustainable development is the "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development promotes the idea that social, environmental, and economic progresses are all attainable within the limits of our earth's natural resources. Sustainable development approaches everything in the world as being connected through space, time and quality of life.

Sustainable development constantly seeks to achieve the social and economic progresses in ways that will not exhaust the earth's finite natural resources. The needs of the world today are real and immediate, yet it is necessary to develop ways to meet these needs that do not disregard the future. The capacity of our ecosystem is not limitless, meaning that future generations may not be able to meet their needs the way we are able to now.

The world's resources are finite, and the growth that is not well-managed nor unsustained would lead to an increased poverty and declined condition of the environment. We owe it to the future generations to explore lifestyles and paths of the development that would effectively balance the progress with an awareness of its environmental impacts. In order to preserve the future, we must appreciate the interconnectedness between humans and nature at all levels. Sustainable Science and Technology practices may help us do this, and through education, research and building awareness, preserving the future is within everyone's reach.

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The 1st International Conference on Science and Technology for Sustainability (ICoSTechs2014) 2014 offers a place and opportunities for researchers and professionals from academic, business, industries, Governments, NGOs, and other sectors to exchange their scientific and technological information. ICoSTechs2014 is also provided for students to present their research papers.

All submissions will be peer reviewed. Accepted papers will be published in the conference proceedings. Selected Paper with a few corrections will be propose to published in **IEEE Xplore Digital Library**, **TELKOMNIKA Journal (Index by SCOPUS and ISI)**, **and IAES Journals (Institute of Advanced Engineering and Science Journals).**

On this occasion I wish to thank the Rector of UIN SUSKA Riau who had agreed to attend on this occasion and be apride for us on his presence, and we also appeal to the Rector in order to open a international seminar was officially. Thank you very much to **Prof Alexander Jakob Boris Zehnder** over a given time, hopefully on the other occasion we may invite you back. Thanks also to **IEEE Indonesia Section**, **BKS-PTN Barat – Engineering**, **International Institute of Islamic Thought (IIIT)**.

Thanks to the invitations has the pleasure to present, thanks to the chairman and the entire committee which has prepared this activities, and also to the all of participants in this seminar, hopefully be beneficial to all of us. Congratulations and hope that with the implementation of this seminar makes our role in the world of science and technology more clearly visible, so our presence is felt by the community. So any remarks from me, finally I apologize if there are words that are not in place. Congratulations.

Dra. Hj. Yenita Morena, M.Si
Dean
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ICoSTechs 2014 Schedule

Wed, October 22nd 2014
Conference Day

07.30 – 10.10	Opening Ceremony
	Coffee Break
10.10 – 12.20	Session I Presentation from Keynote Speaker
	Prof. Zehnder Alexander Jacob Boris
	Moderator: Kunaifi, S.T, M.Sc
13.30 – 15.30	Session II Paralel Presentation
	Moderator Room A : Ismu Kusumanto, M.T
	Moderator Room B : Rika Susanti, S.T, M.Sc
	Coffee Break
15.30 – 16.00	Closing Ceremony

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Frequency Channel Management of HF Radio In Initial Implementation of ALE Stations Network Riau

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Abstract – **Communication in emergency situations is very necessary and should be supported with reliable system. This can be done by applying HF radio communication system. Dependence of HF radio communication on conditions of ionosphere layer causing the need for frequency management of communication. For that needed disclosure information of frequency channel which can be obtained with the implementation of ALE stations. For Indonesian territory western part, especially Riau and surrounding areas implementation of ALE stations can provide the working frequency information in real-time, which can be used between Riau with other regions. The results of frequency management In this research indicates working frequency of circuit Riau-Watukosek 18 MHz, working frequency of circuit Riau-Pontianak 10 MHz and working frequency of circuit Riau-Biak 25 MHZ.**

Keywords – ALE, Frequency Channel Management, HF Radio Communication

I. INTRODUCTION

Advances in technology should be balanced with the use of appropriate technology which is able to provide the best service for customers. For example in the field of telecommunications is required a reliable telecommunications network infrastructure and evenly that is able to handle all conditions.

But in reality the service provider only able to provide service in normal conditions only, whereas in emergency conditions such as earthquakes are not able to give services such as communications due to damage the telecommunications network infrastructure so that it will have difficulty give the information. Therefore, it needs a reliable Communications system that can serving communication especially in emergency situations for all territory of Indonesia. One of the communication tools that can be used is by using communications radio system of High frequency (HF) [7].

HF radio communication system is communication system that utilizes the means which have been provided in nature such as ionosphere layer to be able communicating remotely with the use of frequency allocation from 3-30 MHz [3;16; 12]. However, HF radio communication has its disadvantages such as its dependence conditions of ionosphere layer which resulted that can not use one frequency to each time continuously.

For that needed the use management HF radio channel frequency by do the settings to working

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frequency used as well as time of communication. This can be done with the utilization of HF radio communication technology that are adaptive known as system of ALE (automatic link establishment (ALE). system of ALE can evaluating working frequency would like to use in real time. [13].

To support the HF radio communication system with adaptive all over Indonesia, then conducted development by establishing ALE stations one of them in Riau which is located Laboratory of Electrical Engineering Faculty of Science and Technology, Islamic University of Sultan Syarif Kasim Riau-Indonesian. Implementation of ALE stations located all over Indonesia is useful to be able obtain disclosure channel information (opening channel) from the working frequency of HF radio communication between stations of ALE.

This research doing preliminary assessment by conducting the management to working frequency is used between stations of ALE obtained from implementation of the ALE stations Riau.

A. Radio communication system of high frequency (HF)

HF radio is a solution for the future because it has higher bit rate with relatively low cost without the need for complex telecommunication infrastructure provider and can reach long distances. Utilization of HF radio commonly found in military communications, maritime, and aviation and broadcasting (broadcasting).

HF radio waves have properties could be reflected by ionosphere layer, so that communication from the sender to the receiver can achieve very long distances. MHz [3;16; 12] On the other hand HF radio has a weakness in the propagation which the unstable so that stability level of communication is low This is caused by the characteristics of ionosphere layer which varies from time to time. Dependence of HF radio communication on ionosphere layer causing the use frequency has high sensitivity to changes from the ionosphere so that working frequency in a communication circuit can change at any time. For that needed working frequency evaluation in real-time.

HF radio wave propagation are distinguished accordance with trajectory that is passed from sender to receiver. Wave propagation is the way signal propagates from transmitting antenna to receiving antenna. For HF radio wave propagation can be grouped into three main parts as shown in Figure 1

Radio waves can propagating in three ways, namely propagates are directly (direct wave, direct wave), propagating through the ground (ground wave) and propagating through the sky (sky wave) [6]

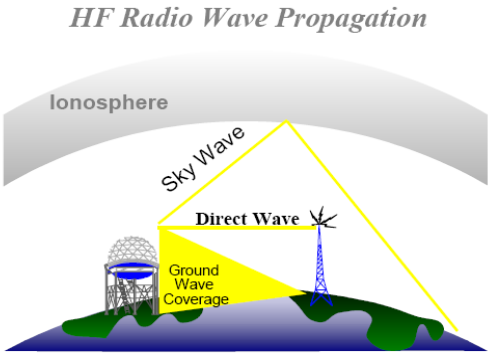

Fig 1. HF Radio Propagation MHz [3;16; 12]

B. Automatic Link Establishment (ALE)

One of the latest technology that is used and was developed within the scope of radio communication of High Frequency (HF) is technology known as Automatic Link Establishment (ALE). This technology offers convenience for HF of radio operators in implementing communication to be conducted. ALE technology emerged as an attempt to overcome any change working frequency that can be used in a of radio communication circuit, as a consequence from dynamics of ionosphere layer. With this system the selection of working frequency of radio on a communication circuit may be done automatically.

ALE system is the system that working by doing channel selection or frequency automatically. Frequency selection conducted based on the analysis of test signal quality of communication in real-time based on frequency allocations owned by such systems. Examination of signal qualitywhich the best of several frequency owned, used as ingredient or basis to determining channel or frequency to be used in communication.

In details mechanisms in ALE system to communicate with the destination stations or desired is presented in Figure 2 To start the communication, the initiator stations summoning accordance with identity

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of the destination stations by using frequency (f1, f2, ..., fn) which has been established or owned. If the destination stations receiving these signal, then response signal which contains identity of stations will be delivered via the same frequency (fc). After receiving the response signal from the destination stations, signal replies (acknowledgment) is sent as a signal to initiate the communication. After the reply signal of acknowledgment is received, then signal for communication of initiator stations delivered and the communication between the two stations can be implemented.

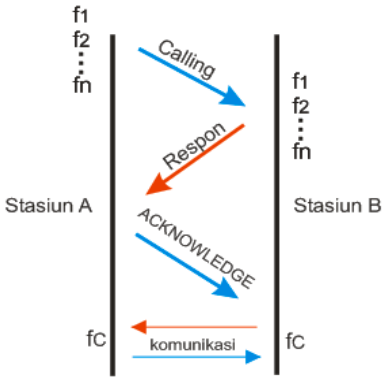

Fig 2. Handshaking Process in ALE system

Remarks :
f1, f2,.., fn : test frequency
fc = communication frequency

In ALE system each stations always in standby mode (standby) or conditions calling (calling). At the time of standby condition, radio the scaning process to check the calls signal of frequencies which are owned or used. these the scaning process has time duration between 0.2 to 0.5 seconds per one frequency and the optional. if the time scanning process is received call signal addressed to these stations, then response signal will be delivered through the same frequency while the process waiting acknowledgment response signal

In the process of calling (calling), the selection of frequency to be used was not random. Frequency selection conducted based on the results of signal quality analysis from each of the existing frequency. these signal quality analysis process known as algorithms of Link Quality Analyze (LQA). The frequency with best quality will be used first to call the destination stations. If was not obtained response of the destination stations in these frequencies, then next best frequency is used to call the destination stations. The process of selecting frequency to call the destination stations continues to obtain response signal. if all frequency have been used to call the destination stations, but was not obtained response signal, then ALE system will notify the operator that communication can not

In the process communication making calls, the composition was made in a matrix. Examples LQA matrix is presented in Table 1 Column of address is column that contains the identity or callsign of each stations. While the column of channels is column of frequency or channel is available which contains information of signal quality value from frequency which may be used to contact these stations. As an example; to communicating with alpha2 stations, available 4 channels that can be used, namely; channels 1, 3, 4, and 5 While for the order of the frequencies used in determining the working frequency to be used to communicate will start from channels 4, 3, 5, and 1.

TABLE 1. RESULT OF LQA THE ALE SYSTEM

Address	Channels				
	01	02	03	04	05
ALPHA 1	60	33	12	81	23
ALPHA 2	10	--	48	86	21
ALPHA 3	--	--	29	52	63

ALE Stations that will be applied in the location Riau are ALE stations that uses conventional radio devices which integrated with the computer. This station have configuration which similar to the application of ALE stations conducted by radio amateurs which incorporated in community of hflink. This is so that in its operation, ALE stations are built may provides data of LQA which may be used to analysis of frequency management is done.

In Figure 3 is presented configuration diagram block of ALE device. In such images was shown that of ALE system was built have 4 main blocks, namely computer, modem, radio transceiver, and antenna. Block of computer has a function as radio control the software as well as storage and processing of LQA data that is controlling the value of radio work frequency as well as the current conditions radiating or receiving. While the modem block functions to controlling radio is mechanically, ADC and DAC, as well as interface of computer data flow with radio. To block of radio transceiver with antenna are hardware that functions as modulation and demodulation of information signal and carrier signal as well receiver and transmitter radio waves from and to free space.

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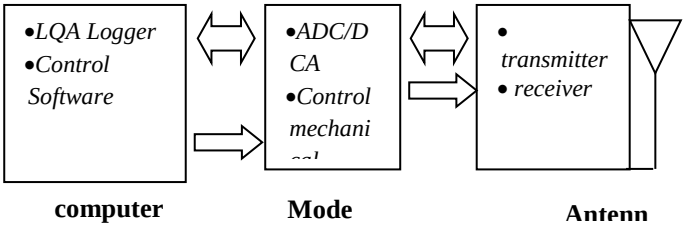

Fig 3. Configuration Diagram Block Of Ale Device

Then broadband antenna are antenna with bandwidth is wide enough, so that when the working frequency which used changes, these antenna is still fit for use (eg SWR value = 1) and very much available in the market known as folded dipole antenna.

Devices of ALE system has been integrated in a communication radio device. In Figure 4. are shown of ALE system configuration using PC and modem / TNC as well examples of radio devices that are integrated with ALE system.

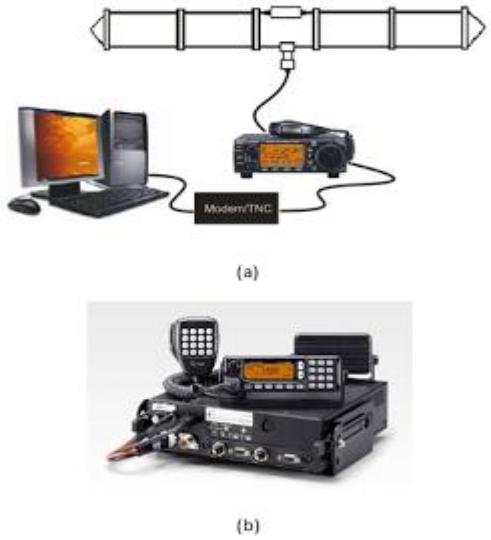

Fig 4. Diagram Block ALE device system (a) Perangkat using Modem TNC and PC (b) radio device ICOM IF-7000

II. Ease of Use

A. Stages Of RESEARCH

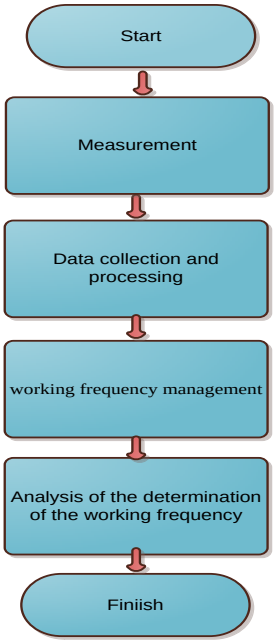

Fig 5, Flowchart of Research

In determining the circuits working frequency of ALE station network Riau with network of ALE national, one of the steps undertaken is to conduct measurements. This step testing success rate of devices installation of hardware and software in generating test data communication between the stations. After this step is skipped, then conducted the data processing aims to facilitate the determination of the working frequency between communication circuits. The last step was conducted is to analyze in determining the working frequency of optiman designated each circuit.

B. Data Processing and Analysis

ALE Stations is stations that destined to evaluate and select the channels from frequency in HF spectrum. Data obtained from ALE network may be processed into working frequency information a communication circuit based on time used. This data was first grouped by source of signal or the received station (callsign ID). From these signal source group the data obtained is then filtered (filter) to eliminate invalid data in accordance with the method [8].

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After such data filtered (filter) then data obtained can be presented in the form of working frequency information based communication time a communication circuit with daily or monthly periods. In detail, it can be stated in the figure 3.4.

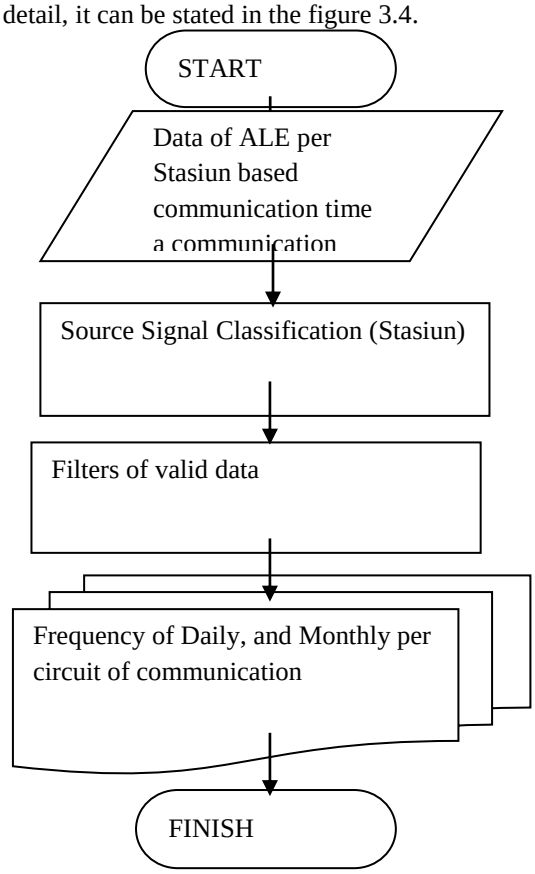

Fig 6 . Diagram processing flow of ALE data

To get an open channel in the HF frequency band from Riau ALE station to another station then conducted the analysis on the results of data processing and analyzing the working frequency management.

Data analyzed in the study was data success HF radio communication frequency which is viewed by time and communication circuits of ALE Riau with other stations. Data processing results can be shown in a daily period and then analyzed for changes in the working frequency to know the difference the frequency of work that can be used every day. To anticipate and based on considerations of planning communication technical are commonly used in HF radio communication, determining an the working frequency general can conducted to scale of monthly period.

From these data will be presented information to management of frequencies that can conducted. The management was conducted are time management of communication based on the the frequency used or usage settings owned working frequency (determined) based on the time of communication success.

With these data can presenting frequency that may be used as well as effectiveness of communication time between the Riau region with the purpose of other areas such as Pontianak Watukosek and Biak.

The methods used in analyzing the working frequency is a method of link quality analysis (LQA). With this method the selection of working frequency is determined based on analysis of data collection result of reception quality of the best working frequency so that it can knowing the frequency of work that can be used in accordance with the conditions of the ionosphere.

III. RESULTS

In this part is the result of management obtained through the stages of data processing and data analysis. The following are the results obtained by performing the management to working frequency for HF radio communication.

A. Results of application and utilization

The establishment of Riau ALE station aims to contribute and provide referral information of open channel to certain time in the propagation frequency band of HF Riau areas and the surrounding with another ALE stations well located on the territory of Indonesia and the International territory

On establishment of station network of ALE Riau is part of ALE national network obtained information data the propagation conditions of HF radio communication in real time between stations of ALE Riau with other ALE stations. working frequency information that can used to communicate using of HF radio which can be accessed by the general public through the website www.hflink.net.

As for utilization of establishment ALE stations in Riau region is useful to as preparation of local government in the face of emergency situations caused by natural phenomena in providing information to the community.

B. Working frequency management toward implementation of ALE stations Riau

From results of application the ALE station Riau obtained the data of communication between stations ALE with other stations of ALE Riau is in the form of

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data the daily variation until the the monthly. As for measurement time to this research that is was conducted in June 2013 to facilitate the conduct of management in determining the working frequency performed filtering process for each of the measurement data. Based on the results from the analysis indicates that 5 ALE station are detected by ALE Riau station only 3 stations that is able management to generating the optimal working frequency among other Pontianak stations, Watukosek stations and Biak station

Data are shown to each circuit in the form of good optimum working frequency are used in communicating over HF radio and supplied with index quality of BER and index quality of SN of each working frequency selected. The following is the result of data processing management the measurement results of ALE station Riau

- Circuit working frequency Riau Watukosek

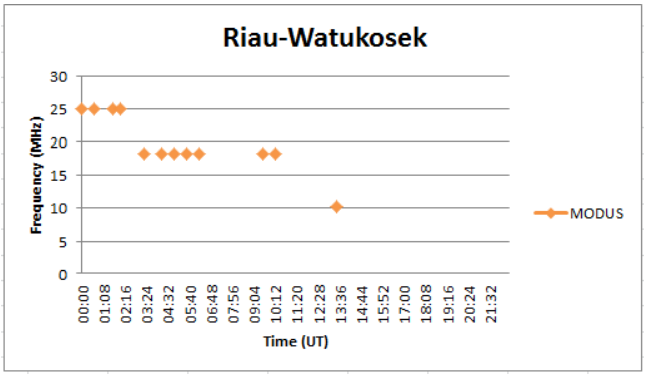

Fig 7. Working frequency Riau- Watukosek

- Circuit working frequency Riau –Pontianak

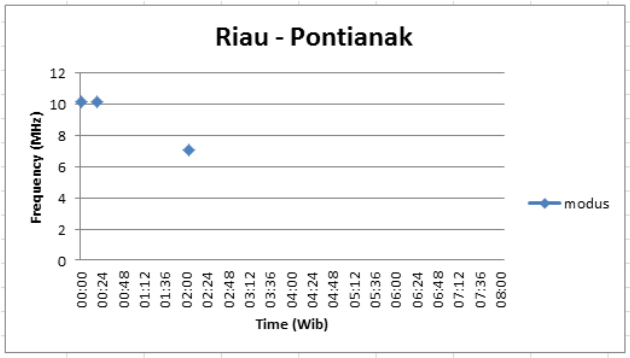

Fig 8. Working frequency Riau – Pontianak

- Circuit working frequency Riau –Biak

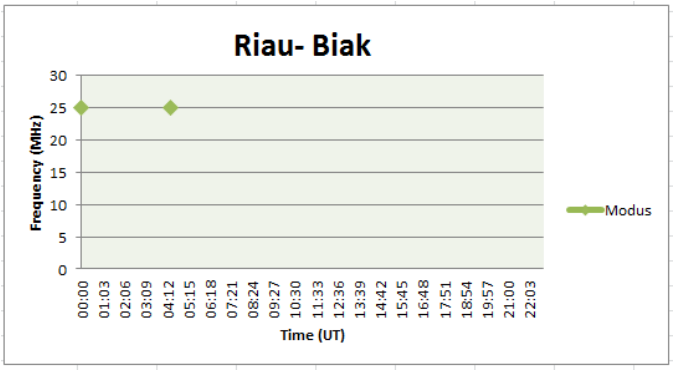

Fig 9. Working frequency Riau- Watukosek

- Index quality BER

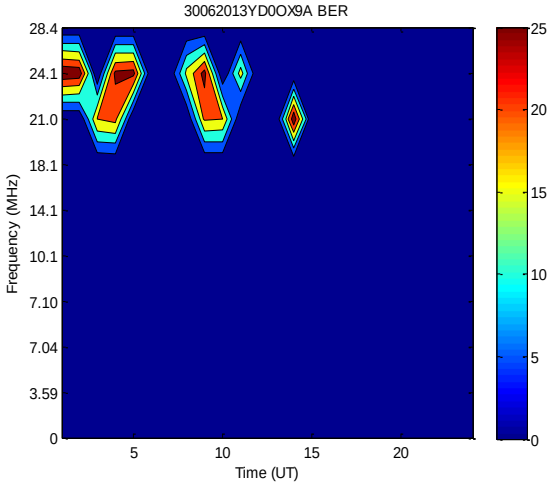

Fig 10. Index quality BER

- Index quality SN

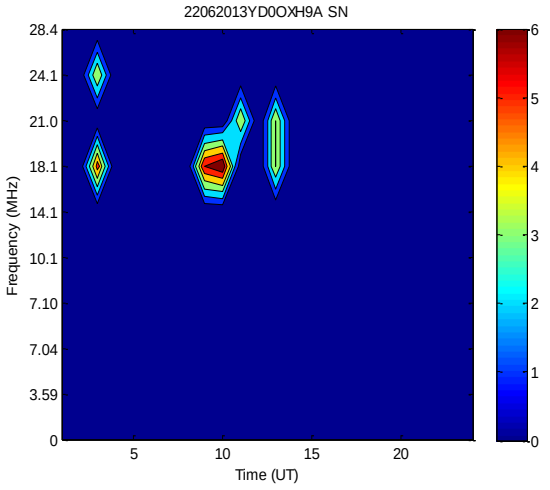

Fig 11. Index quality BER

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In figure 7 can be presented working frequency information that can be used between stations Riau with Watukosek station in June 2013 Based on these data it can be determined that the dominant working frequency is 18 MHz and can be be used as working frequency reference for the month of June 2013, while the choice of working frequency was 25 MHz. In figure 8 can be presented working frequency information that can be used between stations Riau with Pontianak station with the dominant working frequency is 10 MHz while the choice of working frequency was 7 MHz. For In figure 9 can be presented working frequency information that can be used between stations Riau with with Biak station with the dominant working frequency was 25 MHz. Differences in the use of working frequency is affected due to the changes that occur in ionosphere layer. To determine the quality index of BER and SN to each working frequency are selected can be seen in Figure 10 and 11.

IV. CONCLUSION

From results of working frequency management toward the implementation of ALE station Riau obtained some conclusions

1. The success of communication test at the time of implementation the ALE station Riau covering between circuit of Riau -Watukosek, Riau-Pontianak and Riau- Biak.
2. Based on frequency management is conducted between the circuit Riau Watukosek known working frequency reference was 18 MHz and the choice working frequency by 25 MHz
3. Based on frequency management is conducted between the circuit Riau Pontianak known working frequency reference was 10 MHz and the choice working frequency was 7 MHz
4. Based on frequency management is conducted between the circuit Riau Biak known working frequency reference was 25 MHz
5. with known openness of channel for certain circuit can be used as working frequency reference by the user to perform communication using HF radio communication system.
6. Difference the use of working frequency affected due to the changes that occur in ionosphere layer

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